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## Bopyrid Isopods Parasitic on Decapod Crustaceans in Korea

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韓國產 十脚寄生科 等脚類(節肢動物門 甲殼上綱)

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### 通 要

한국해역의 35개 지점에서 채집된 甲殼十脚類에 기생하는 十脚寄生科 等脚類를 조사한 결과 7아과 12속 12종이 동정·분류 되었다. 이 중 다음 8종은 한국에서 처음으로 보고된다:

*Metabopyrus ovalis* Shiino, *Bopyrissa pyriforma* (Shiino), *Ione cornuta* Spence Bate, *Parapenaeonella distincta* Shiino, *Bopyroides hippolytes* (Krøyer), *Pseudotegias dulcilacuum* Markham, *Athelges takanoshimensis* Ishii 및 *Eophrinx shojii* Shiino. *Athelges japonicus* Shiino는 *A. takanoshimensis* Ishii의 同物異名으로 밝혀졌다. 미기록종에 대하여는 도판과 함께 기재하였고, *Apocapon pulcher* Nierstrasz et Brender à Brandis와 *Argeia pugettensis* Dana는 도판을 작성하였다.

Key words: Bopyridae, Isopoda, Taxonomy, Korea.

### INTRODUCTION

The family Bopyridae is a group of isopod crustaceans ectoparasiting on decapod crustaceans. Approximately 500 species of bopyrids were described and classified into ten subfamilies. Most of them

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본 연구는 1984-1985년도 한국과학재단의 연구비 지원에 의하여 수행된 것임.

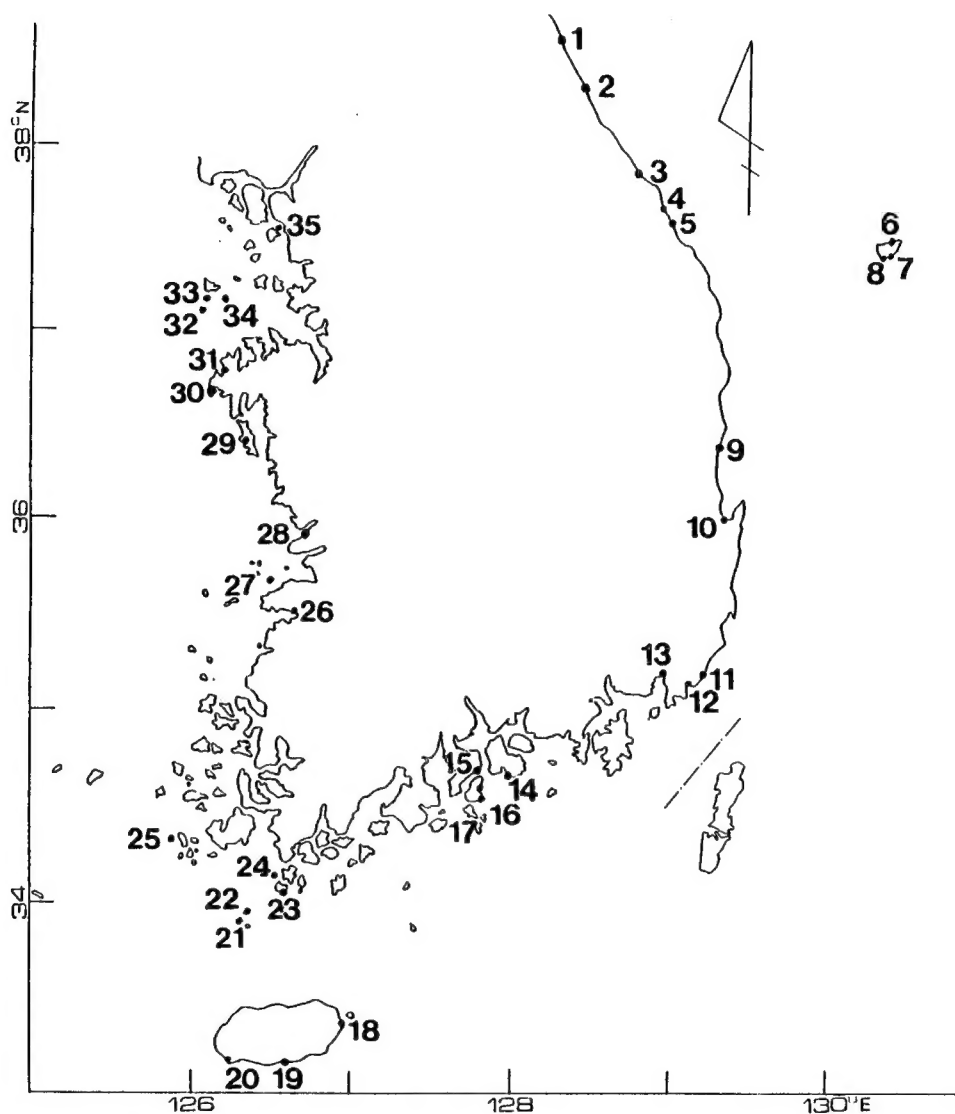


Fig. 1. Collecting localities.

- 1, Kōjin (巨津); 2, Sokch'o (束草); 3, Kangnŭng (江陵); 4, Mukho (墨湖); 5, Hujin (後津); 6, Ch'ŏnbu, Ullŭngdo I. (鬱陵島 天府); 7, Todong, Ullŭngdo I. (鬱陵島 道洞); 8, Sadong, Ullŭngdo I. (鬱陵島 沙洞); 9, Kanggu (江口); 10, P'ohang (浦項); 11, Kijang (機張); 12, Mip'o, Pusan (釜山 尾浦); 13, Mouth of the Nakdong River (洛東江 河口); 14, Sangju-ri, Namhaedo I. (南海島 尙州里); 15, Yōsu (麗水); 16, Imp'o, Tolsando I. (突山島 荏浦); 17, Pangch'ukp'o, Tolsando I. (突山島 防築浦); 18, Sōngsanp'o, Cheju I. (濟州島 城山浦); 19, Sōgwip'o, Cheju I. (濟州島 西歸浦); 20, Mosŭlp'o, Cheju I. (濟州島 慕瑟浦); 21, Sangch'ujado I. (上楸子島); 22, Hoenggando I. (橫干島); 23, Pogildo I. (浦吉島); 24, Nōpto I. (茆島); 25, Nulokto I. (訥玉島); 26, Munyōdo I. (巫女島); 27, Komso (곰소); 28, Kunsan (群山); 29, Pangp'o, Anmyōndo I. (安眠島 傍浦); 30, Anhŭng (安興); 31, Chōllip'o (千里浦); 32, Sōngapto I. (仙甲島); 33, Mungapto I. (文甲島); 34, Soyado I. (蘇爺島); 35, Changyakto I. (芍藥島).

are branchial parasites, but members of two large subfamilies, the Athelginae and the Hemiarthrinae, are abdominal parasites of hermit crabs and caridean shrimps, respectively.

The family Bopyridae has been very poorly known from Korea. Previously, only four species have been recorded from Korea, despite a fairly large body of knowledge of decapod crustaceans there, while about 90 species from Japan (Shinno, 1972) and 23 species from Hong Kong (Markham, 1980) were known respectively. Richardson (1909) reported 2 bopyrids, *Phrixus abdominalis* Krøyer and *Argeia pugettensis* Dana, from off coasts of Kuryongp'o (Sea of Japan). But the record of *P. abdominalis* (later transferred to the genus *Hemiarthrus*) in Korean waters requires verification. Recently, Choe and Kwon (1982) included *Apocepon pulcher* Nierstrasz et Brender à Brandis in their list of marine invertebrate fauna of Tökchök Archipelago in the Yellow Sea. Kim and Kwon (1988) described and illustrated *Pleurocrypta yatsui* (Pearse) and *Parathelges enoshimensis* Shiino from Cheju Island.

The authors made the extensive collections of decapod crustaceans from various localities in Korea during the period from 1984 to 1986. Other material in the collections of the Department of Zoology, Seoul National University and the Department of Biology, Inje College were also examined. Bopyrid isopods were found from 35 localities (Fig. 1). Twelve species were identified and classified into 12 genera and 7 subfamilies, of which 8 species are new to Korea. Specimens are deposited in the Department of Biology, Inje College.

## SYSTEMATIC ACCOUNT AND DESCRIPTIONS

Suborder Epicaridea Latreille, 1831    寄生 亞目  
 Family Bopyridae Rafinesque, 1815    十脚寄生 科(新칭)  
 Subfamily Pseudioninae    R. Codreanu, 1967  
 Genus *Metabopyrus* Shiino, 1939

### 1. *Metabopyrus ovalis* Shiino, 1939    쪽아감벌레 (신칭) (Fig. 2)

*Metabopyrus ovalis* Shiino, 1939b (pp. 88-91, figs. 7-8); 1958 (pp. 48-49, fig. 10).

**Material examined:** 1♀, Komso, May, 1978, (I.H. Kim), infesting *Upogebia major* (de Haan, 1849).

**Description:** **Female**—Length 13.4mm, width 10.5mm across pereomere IV. Body ovate and rather smoothly rounded, slightly asymmetrical. Dorsal surface flattened, without pigment. All body segments distinct.

Cephalon distinct from pereon, subtriangular, deeply set into pereon; anterior margin more or less rounded, lateral borders somewhat irregular and convergent posteriorly. Frontal lamina not developed. Eyes distinct mediolaterally, lacking pigment. First antenna of three articles; terminal article minute; distal two articles setose distally. Second antenna of four articles, slightly longer than first antenna; distal two articles setose; terminal article minute. Posteroventral border of cephalon with two pairs of digitate lateral projections; medial region also digitated. Maxilliped distinctly two-segmented, relatively broad, lacking palp and palpal setation, with prominent spur.

All pereomeres separate. Dorsolateral bosses on both sides of pereomeres I-IV. Coxal plates well developed on both sides of pereomeres I-IV and completely covering lateral margins of respective pereomeres. Pereomeres V-VII with posterolateral corner acutely produced on both sides. Oostegites completely enclosing brood pouch. Oostegite I with deep external groove; anterior region deeply concave internally, internal ridge digitated; posterolateral projection linguiform, extended posteriorly.

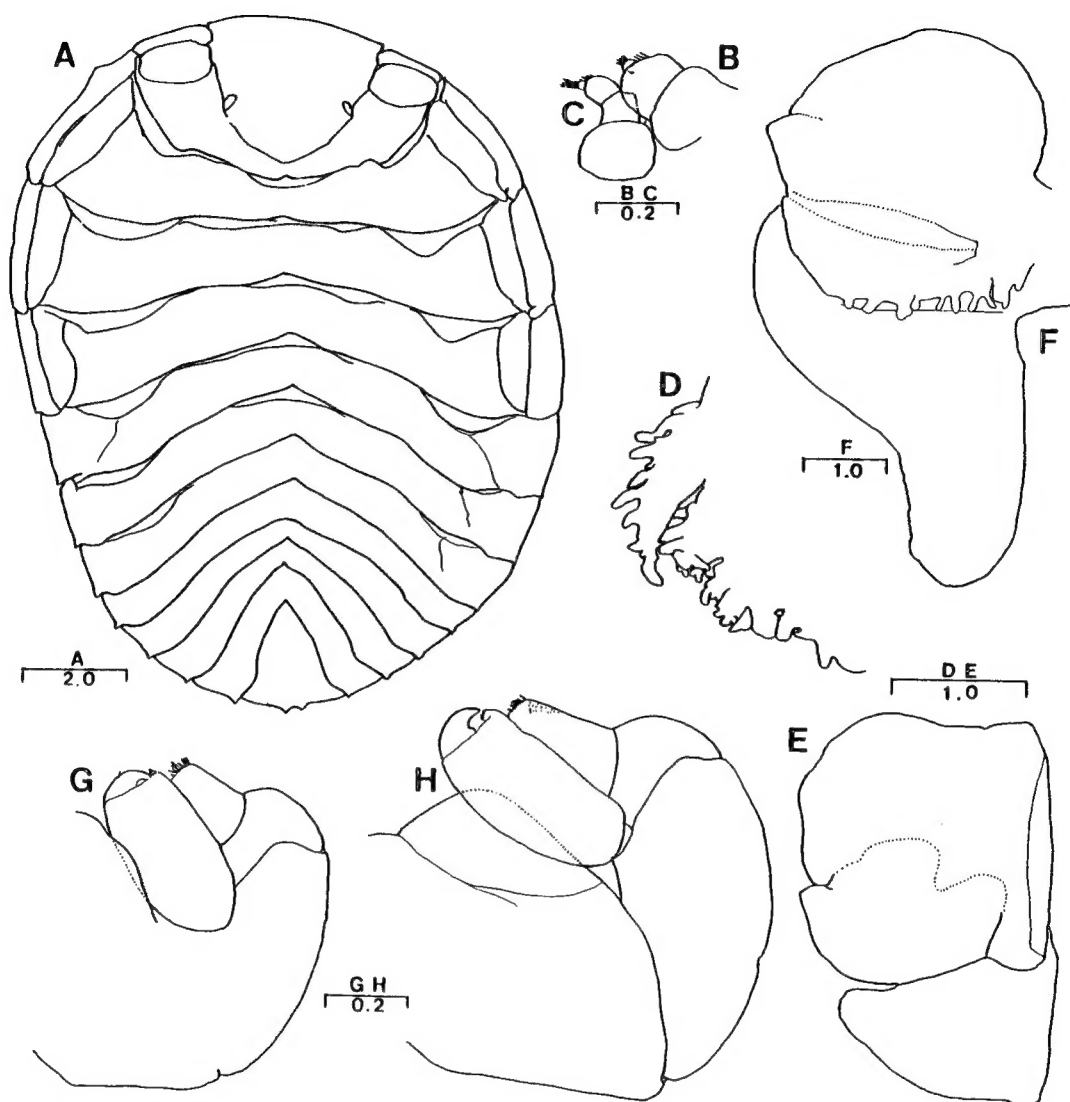


Fig. 2. *Metabopyrus ovalis* Shiino, female: A, dorsal view; B, right first antenna; C, right second antenna; D, right posteroventral border of cephalon; E, right maxilliped; F, right oostegite I, inner view; G, right pereopod I; H, right pereopod VII. Scale bars in mm.

All pereopods similar, progressively larger posteriorly; all articles distinct; dactyli rather small; propodi produced into "socket" receiving end of dactyli; carpi with tufts of setae distally; bases carinate, becoming prominent posteriorly.

Pereon of only five pleomeres, lacking lateral plates; first four pleomeres resembling posterior three pereomeres. Last pleomere bell-shaped with a median notch, of which both sides acutely produced. Five pairs of pleopods tuberculated on both rami; endopods bilobed, exopods not bilobed. Uropod uniramous, foliaceous and tuberculated.

**Remarks:** *Metabopyrus ovalis* is the sole member of the genus. Shiino (1939b) recorded the host of this species under the name of *Upogebia major* (de Haan), but later (Shiino, 1958) emended the host to be assigned to *U. issacffi* Balss. Single female specimen for the present study was found infesting

*U. major*.

The present specimen fits well with the descriptions by Shiino (1939b, 1958). However the former bears no palp on maxilliped, while Shiino (1958)'s specimen bears a small triangular palp. This is the first record of the species outside Japan.

**Distribution:** Korea and Japan.

Genus *Bopyrissa* Nierstrasz et Brender à Brandis, 19312. *Bopyrissa pyriforma* (Shiino, 1958) 넓적원손집게아감벌레 (신칭) (Fig. 3)

*Pseudionella pyriforma* Shiino, 1958 (pp. 41-43, fig. 7).

*Bopyrissa pyriforma*: Bourdon, 1979 (p. 141); Markham, 1980 (pp. 333-336, figs. 6-7).

**Material examined:** Infesting *Diogenes edwardsii* (de Haan, 1849), 1♀, Munyōdo I., Jul. 26, 1980, (W. Kim); 1♀, 1♂, Chagyakto I., Jul. 16, 1980, (D. H. Kwon).

**Description:** Female—Length 4.0-6.3mm, maximum width 2.5-3.7mm across pereomere III. Body asymmetrically pyriform with double torsion. Dorsal surface more or less concave. All body segments distinct.

Cephalon deeply sunk in pereon but distinct from it; anterior margin rounded with well-defined frontal lamina along all of it. Eyes wanting. Both antennae of two articles; first antenna with terminal article setose distally; second antenna lacking distal setae. Posteroventral border of cephalon bearing a pair of inwardly turning acuminate projections plus a pair of short ones medial to them. Maxilliped broad, lacking palp nor flap, with small spur.

Pereon broadest across pereomere III. Dorsolateral bosses inconspicuous, but present in first four pereomeres, rather prominent on longer side of body. Coxal plates absent. Pereomeres I-IV with lateral margins bilobed submedially. Oostegites completely enclosing brood pouch. Oostegite I with deep external groove, internal ridge digitated; posteroventral projection sharply pointed, reflexed and extended posteromedially. All pereopods, similar, increasing slightly in size posteriorly; meri and carpi variably fused or separated.

Pleon of four or five pleomeres, lacking lateral plates. Four pairs of pleopods biramous; both rami triangular, becoming smaller and narrower posteriorly; endopod directed inwards, exopod outwards. Uropod uniramous, very small and lanceolate.

**Male**—Length 1.0mm, maximum width 0.4mm across pereomere V. Body elongate, oval. No eyespots. Cephalon fused with pereonite I, though lateral notches indicating juncture. Both antennae of three articles. All articles of first antenna with tufts of distal setae. Second antenna with minute terminal article; distal two articles sparsely setose distally.

All pereomeres separated by lateral incisions. All pereopods of same size; all articles distinct; carpi sparsely setose distally. Pleon abnormal, with only single pleomere bearing a pair of uniramous pleopods.

**Remarks:** Five pleomeres in the female are diagnostic for *Bopyrissa*. However a female from Chagyakto Island has only four pleomeres (Fig. 3A), while one from Munyōdo Island has five (Fig. 3B). Korean female specimens resemble the holotype from Japan in the inconspicuous dorsolateral bosses (Shiino, 1958), while a female from Hong Kong has better developed ones (Markham, 1980). But Korean female specimens differ from those from Japan and Hong Kong in the lack of maxillipedal flap. A male specimen from Hong Kong differs from those from Korea and Japan in having more nearly parallel sides. Though the shape of posterolateral border of female's cephalon seems highly unusual, it is very

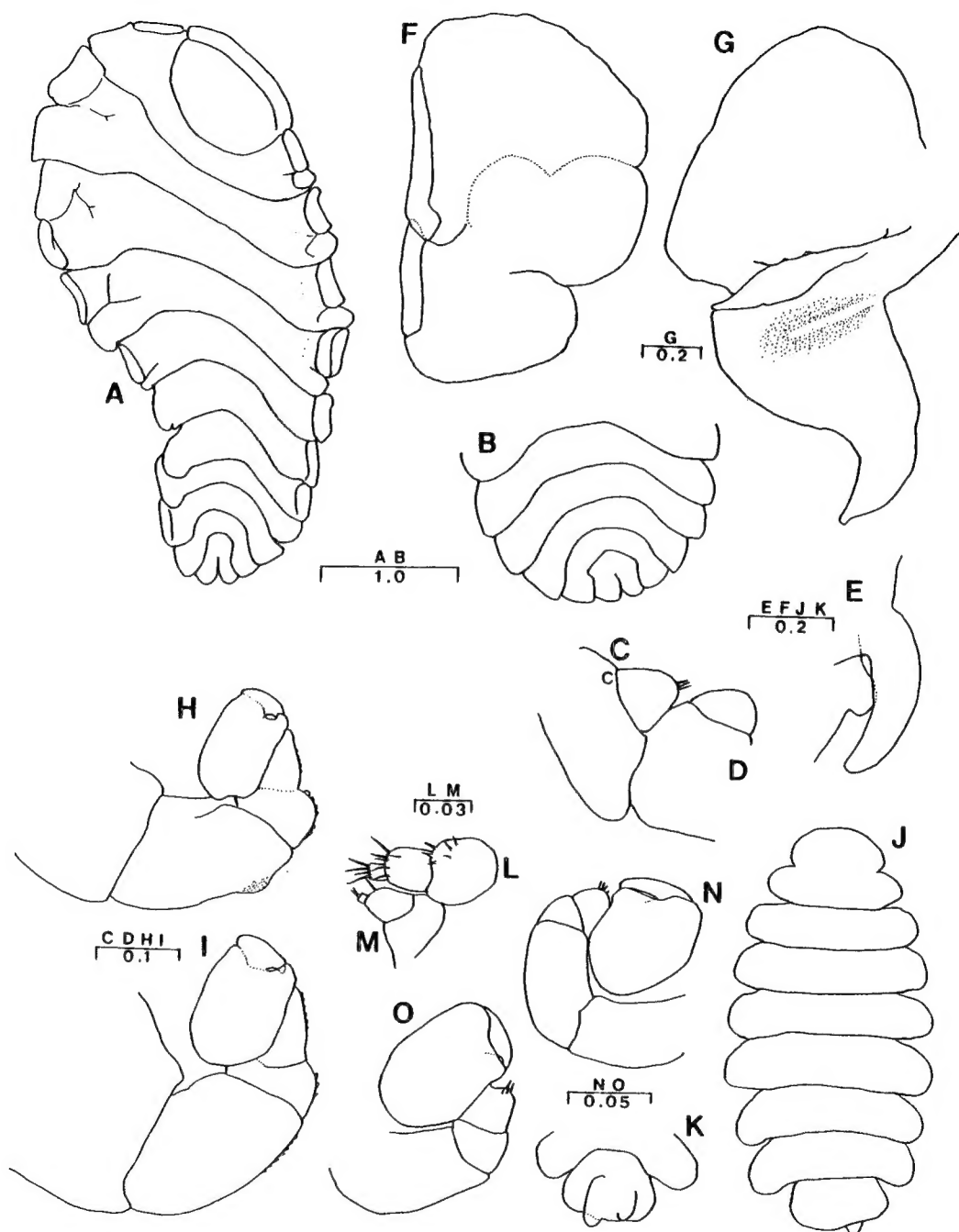


Fig. 3. *Bopyrissa pyriforma* (Shiino). A-I. female: A, dorsal view (with 4 pleomeres); B, pleon of another female (with 5 pleomeres); C, left first antenna; D, left second antenna; E, left posteroventral border of cephalon; F, left maxilliped; G, left oostegite I, outer view; H, left pereopod I; I, left pereopod VII. J-O. male: J, dorsal view; K, pleon of same in ventral view; L, right first antenna; M, right second antenna; N, right pereopod I; O, right pereopod VII. Scale bars in mm.

similar to that from Hong Kong, while the holotype bears the "Single pair of internally turning acuminate hooks," (Shiino, 1958).

Hosts are *Diogenes edwardsii* (de Haan) in Korea and Japan, and *Clibanarius bimaculata* (de Haan) in Hong Kong. In Hong Kong, *D. edwardsii* is known as a host of other bopyrid, *Athelges takanoshimensis* Ishii (Markham, 1980), which infests various pagurid hermit crabs in the genus *Pagurus* in Korea and Japan.

This is the first record of the species in Korea.

Distribution: Korea, Japan and Hong Kong.

#### Genus *Pleurocrypta* Hesse, 1865

### 3. *Pleurocrypta yatsui* (Pearse, 1930) 갯가재불ैया감벌레

*Probopyrus yatsui* Pearse, 1930 (pp. 5-6, figs. 19-21).

*Pleurocrypta yatsui*: Shiino, 1933 (pp. 259-263, fig. 4); Kim and Kwon, 1988, (pp. 222-225, fig 7).

**Material examined:** 1♀, Sŏgwip'o, Cheju I., Aug. 18, 1969, (H.S. Kim), infesting *Petrolisthes japonicus* (de Haan, 1849).

**Remark:** This species was recently recorded from Cheju I. in Korea (Kim and Kwon, 1988).

Distribution: Korea and Japan.

Subfamily Ioninae H. Milne Edwards, 1840, emend. R. Codreanu, 1967

Genus *Ione* Latreille, 1817

### 4. *Ione cornuta* Spence Bate, 1864 쪽불ैया감벌레 (신칭) (Fig. 4)

*Ione cornuta*: Bate and Westwood, 1868 (p. 253); Richardson, 1899 (p. 869); 1904 (p. 75); 1905 (pp. 504-505); Shiino, 1939a (pp. 13-17, figs. 2-3).

**Material examined:** Infesting *Callianassa japonica* (Ortmann, 1892), 1♀, 1♂, Sangju-ri, Namhaedo I., May 27, 1983, (D.H. Kwon); 4 ♀♀, 2♂♂, Sangju-ri, Namhaedo I., May 13, 1984, (D.H. Kwon).

**Description:** Female—Length 10.1 mm excluding uropods and lateral plates, maximum width 7.4 mm in largest specimen. Length/width ratio ranges 1.37-1.39. Body pyriform, slightly asymmetrical.

Cephalon distinct from pereon, broader than long, anterior margin bilobed; posterior half sunk in pereon. Frontal lamina lamellar, well developed, extending far beyond lateral borders of cephalon. First antenna of three articles; terminal article setose distally. Second antenna of five articles with distal three articles setose distally. Posteroventral border of cephalon with two pairs of falcate lateral projections. Maxilliped with small spur, lacking palp.

All pereomeres separate, broadest across pereomere III. Dorsolateral bosses present on pereomeres I-IV. Coxal plates lamellar, well developed on both sides of all pereomeres. Oostegites completely enclosing brood pouch. Oostegite I with both internal and external ridges digitated, posterior border rounded rather than produced into point. Pereopods progressively larger posteriorly; dactyli well developed; propodi produced ventrodistally; carpi setose distally; carpi and meri incompletely fused. Pereopod I with basis carinate.

Six pleomeres separate, transverse. Lateral plates well developed and elongated in all pleomeres, branched and digitated. Five pairs of pleopods biramous; exopods lanceolate, tapering distally, directed externally; endopods decreasing in size posteriorly; 1-3 triangular, lamellar, directed internally, 4 and 5, though sometimes lacking, lanceolate and similar to but shorter than exopods. Uropod uniramous, elongated, not digitated, curled distally.

**Male**—Length 3.0-3.5 mm, width 1.0 mm. Body subparallel. Cephalon broader than long, separated

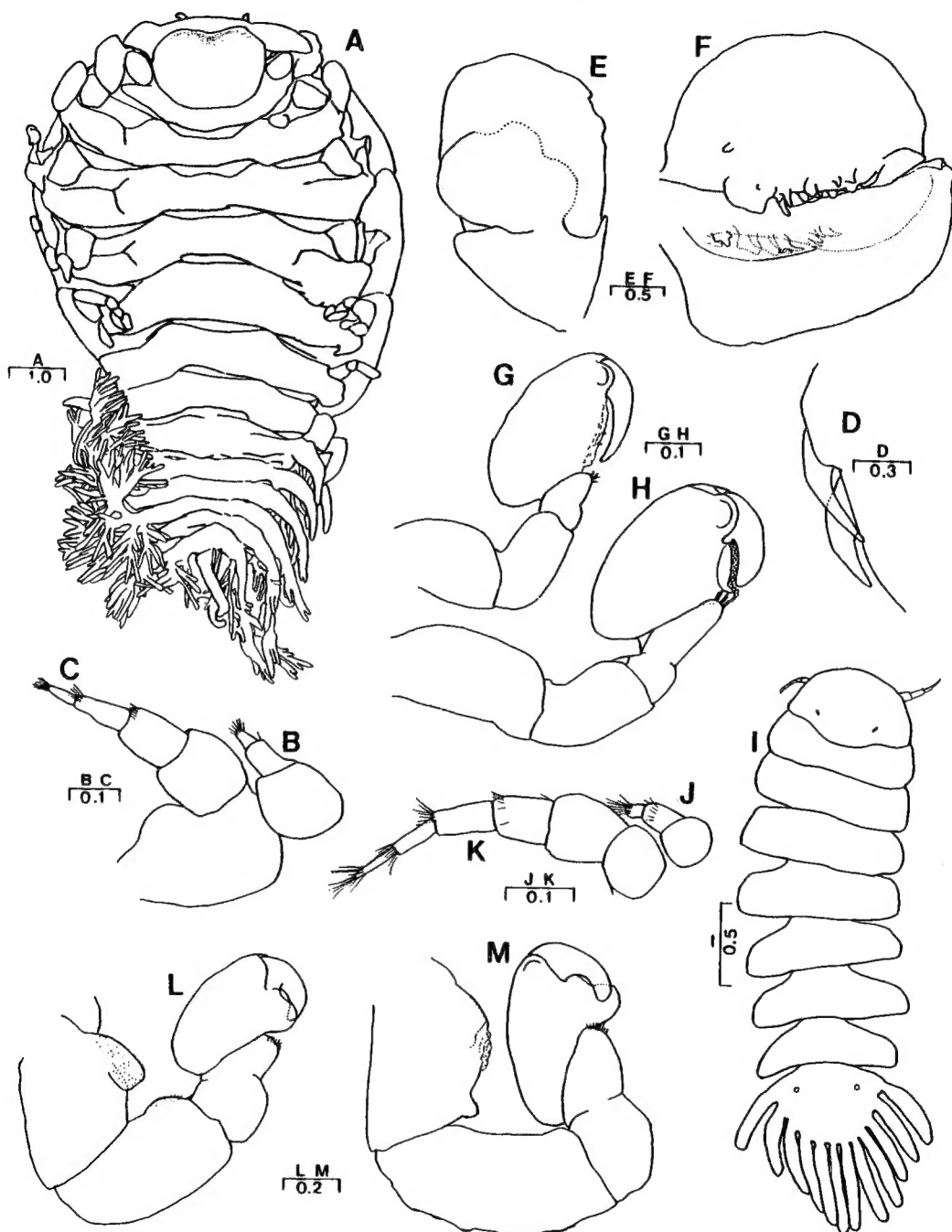


Fig. 4. *Ione cornuta* Spance Bate. A-H. female: A, dorsal view; B, right first antenna; C, right second antenna; D, right posteroventral border of cephalon; E, right maxilliped; F, right oostegite I, inner view; J, right first antenna; K, right second antenna; L, right pereopod I; M, right pereopod VII. Scale bars in mm.

from pereon; anterior margin semicircular; posterior border produced posteriorly in the middle. Eyes small. First antenna of three articles; distal two articles setose distally. Second antenna long, extending far beyond cephalic margin, of six articles.



All pereomeres distinct, separated laterally by notches of different shapes. Pereopods progressively longer posteriorly; dactyli well developed, propodi granulated on ventral margin, carpi setose distally, carpi and meri variably fused; bases of pereopods III-VII produced dorsally. Posterior pereopods with carpi much longer than those of anterior pereopods.

Pleon triangular or hemicircular, fused into single piece, showing remnants of pleomeres indicated by lateral notches and lateral plates. Six pairs of lateral plates lanceolate, elongated. Pleopods and uropods lacking.

**Remarks:** Bate's description of the present species is a brief one (Richardson, 1905), but Shiino (1939a) presented a detailed description based on a female carrying a male collected in Japan. Shiino (1939a) pointed out that Japanese female specimen differs from American specimen in having somewhat narrower body, lateral plates that are not so remarkably developed with different aborescent condition, and the pleopod 5 bearing exopod much longer than endopod. The present female specimens have ovoid body and better developed lateral plates than Japanese specimen. But, in the present specimens, some lack endopod of pleopod 4 and both rami of pleopod 5. All lack endopod of pleopod 5. When present, however, endopods of pleopod 4 are much shorter than exopods.

This is the first record of the species in Korea.

**Distribution:** Korea, Japan and the Pacific coasts of North America from British Columbia and Vancouver.

#### Genus *Apocepon* Nierstrasz et Brender à Brandis, 1930

##### 5. *Apocepon pulcher* Nierstrasz et Brender à Brandis, 1930 밤게아감벌레 (신칭) (Fig. 5)

*Apocepon pulcher* Nierstrasz et Brender à Brandis, 1930 (pp. 7-9, figs. 17-20); Shiino, 1934 (p. 273, fig. 7); 1936a (p. 170); 1936b (pp. 185-186); 1939b (p. 98).

**Material examined:** Infesting *Philyra pisum* de Haan, 1841, 1♀, 1♂, Söngapto I., Aug. 8, 1982, (D. H. Kwon); 5♀♀, 3♂♂, Mungapto I., Aug. 4, 1982, (D.H. Kwon); 6♀♀, 1 immature ♀, 7♂♂, Söngch'on, Soyado I., Aug. 6, 1982, (D.H. Kwon); 2♀♀, 2♂♂, Chagyakto I., Jul. 16, 1980, (D.H. Kwon).

**Remarks:** In Korea, this species was previously recorded from Mungapto I., Söngapto I. and Soyado I. (Choe and Kwon, 1982).

**Distribution:** China from Tsingtau, Korea and Japan.

#### Subfamily Argeiinae Markham, 1977

#### Genus *Argeia* Dana, 1853

##### 6. *Argeia pugettensis* Dana, 1853 진흙새우아감벌레 (Fig. 6)

*Argeia pugettensis*: Richardson, 1899 (p. 868); 1904 (pp. 60-64, figs. 35-40); 1905 (pp. 544-550, figs. 586-597); Fee 1926 (p. 28); Nierstrasz et Brender à Brandis, 1923 (p. 87); Shiino, 1933 (pp. 277-279, fig. 11); 1937 (p. 299); Hatch, 1947 (p. 224, pl. 9, figs. 110-112); George and Strömberg, 1968 (p. 253); Markham, 1977 (pp. 112-114).

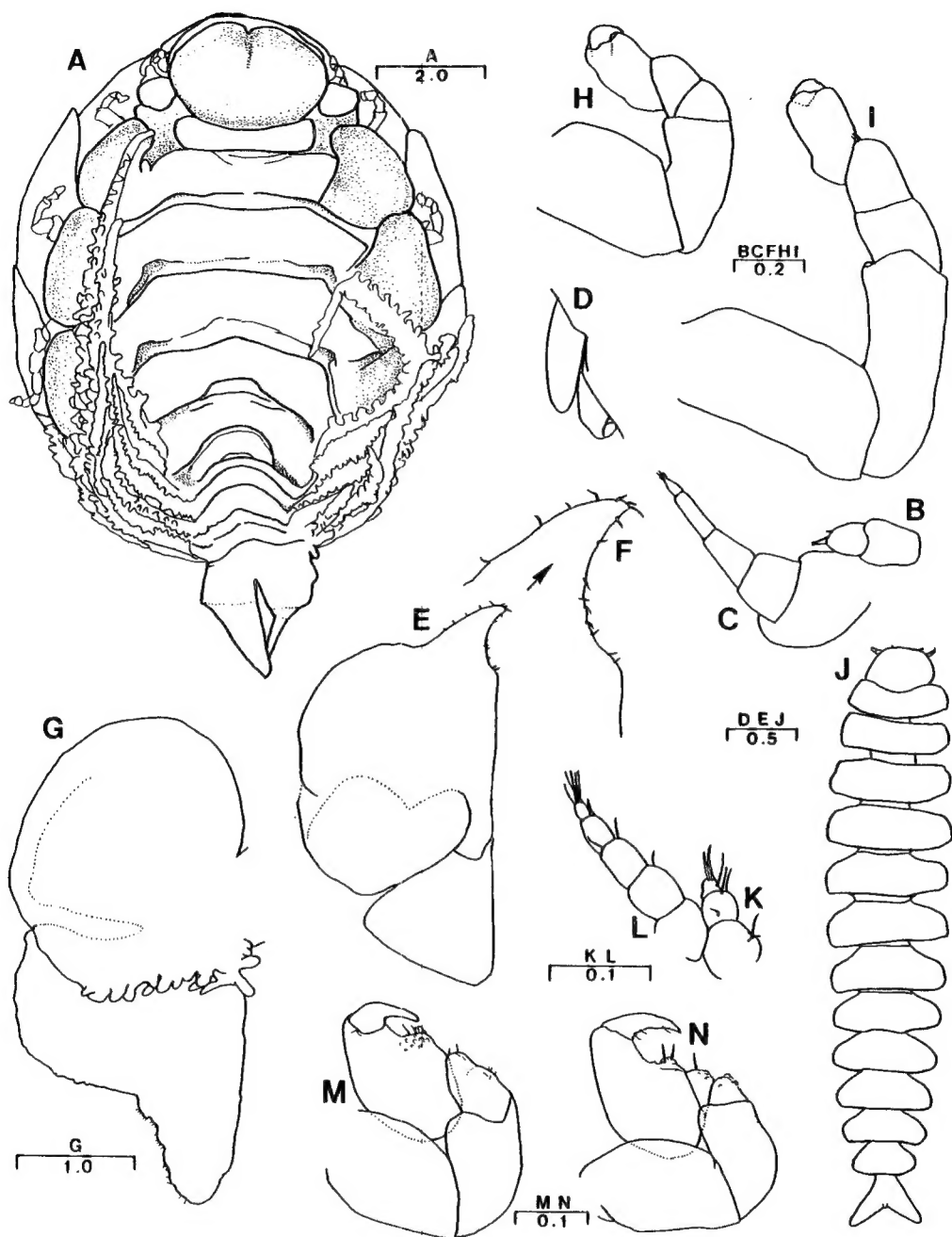
*Argeia pauperata*: Richardson, 1905 (p. 551); Nierstrasz et Brender à Brandis, 1923 (p. 87).

*Argeia depauperata* (sic) — Richardson, 1898 (p. 868).

For further synonymy, see Markham (1977).

**Material examined:** Infesting *Argis lar* (Owen, 1839), 11♀♀, 5♂♂, Mukho, Apr. 19, 1980, (I.H. Kim); 1♀, P'ohang, Feb. 28, 1976, (H.S. Kim).

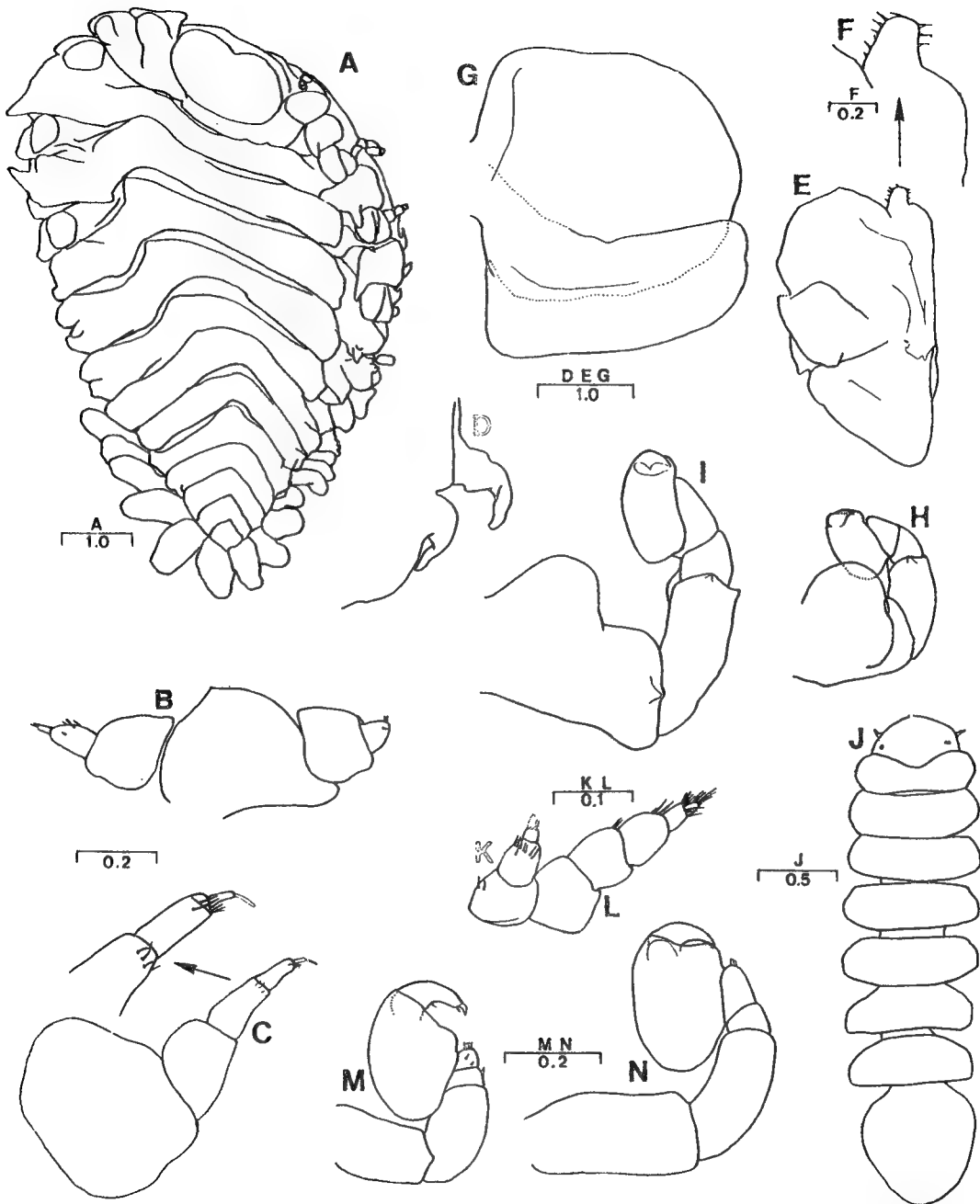
Infesting *Crangon* (*Crangon*) *affinis* (de Haan, 1849), 2♀♀, 3♂♂, Paekhaptūng, rivermouth of the



**Fig. 5.** *Apocepon pulcher* Nierstrasz et Brender à Brandis. A-I. female: A, dorsal view; B, right first antenna; C, right second antenna; D, right posteroventral border of cephalon; E, right maxilliped; F, palp of same; G, right oostegite I, inner view. J-N. male: J, dorsal view; K, right first antenna; L, right second antenna; M, right pereopod I; N, right pereopod VII. Scale bars in mm.

Naktong River, Jun. 6, 1981, (H.S. Kim); 1♀, Sangju-ri, Namhaedo I., May 27, 1983, (D.H. Kwon).

Infesting *Crangon* (*C.*) *affinis* and/or *C. (C.) hakodatei* (Rathbun, 1902), 2♀♀, 1♂, Komso, Apr. 4, 1983, (D.H. Kwon).



**Fig. 6.** *Argeia pugettensis* Dana. A-I. female: A, dorsal view; B, first antennae; C, left second antenna; D, left posteroventral border of cephalon; E, right maxilliped; F, flap of same; G, right oostegite; H, right pereopod I; I, right pereopod VII. J-N. male: J, dorsal view; K, right first antenna; L, right second antenna; M, right pereopod I; N, right pereopod VII. Scale bars in mm.

**Remarks:** Richardson (1905) described and figured *Argeia pugettensis*, including juveniles and aberrant forms, and so did Shiino (1933) again. Therefore further description here is unnecessary, but a few variations were observed: first antennae of female composed of two or three segments; second antennae of both female and male of five segments, last segment minute.

Markham (1977) regarded *A. pauperata* Stimpson as a junior synonym of *A. pugettensis* and gave extensive synonymies, localities and hosts. *Crangon* (*Crangon*) *hakodatei* is recorded for the first time as a host for this parasite.

In Korea, this species was previously recorded from off Kuryongp'o, 36° 30' 30" N, 129° 43' E, (Richardson, 1909).

**Distribution:** Asiatic and American sides of the North Pacific, including Korea and Japan.

Subfamily Orbioninae R. Codreanu, 1967

Genus *Parapenaenella* Shiino, 1949

**7. *Parapenaenella distincta* Shiino, 1949** 꽃새우아감벌레 (신칭) (Fig. 7)

*Parapenaenella distincta* Shiino, 1949 (pp. 59-60, fig. 1); 1958 (pp. 50-51, fig. 12).

**Material examined:** Infesting *Trachypenaes curvirostris* (Stimpson, 1860). 5♀♀, 4♂♂, Yosu fish market, Jun. 20, 1980, (D.H. Kwon); 1♀, Nulokto I., Jul. 28, 1983, (D.H. Kwon); 1♀, Kunsan fish market (probably captured from Almado I. or Wido I.), Sep. 15, 1971, (B.L. Choe).

**Description:** **Female**—Body ovate; nearly symmetrical. All body regions and segments distinct, but separations between anterior pereomeres and some pleomeres sometimes obscure medially. Separation between cephalon and pereon obscure medially. Cephalon as long as broad, deeply sunk in pereon, bilobed anteriorly. Frontal lamina well developed, lamellar, covering all of anterior margin of cephalon. First and second antennae of three and five articles, respectively; some terminal articles sparsely setose distally. Posteroventral border of cephalon with two pairs of digitate lateral projections. Maxilliped not segmented with palp, lacking palpal setae.

Pereon broadest across pereomere IV. Separation between pereomeres II-IV sometimes obscure medially. Dorsolateral bosses well developed on pereomeres I-V. Coxal plates lamellar, margins irregular, developed on all pereomeres. Oostegites completely enclosing brood pouch. Oostegite I with deep external groove; anterior region deeply concave internally with internal ridge digitated; posterolateral projection linguiform, moderately extended posteriorly. Pereopods all similar, progressively larger posteriorly; all articles distinct; carpi bearing sparse minute setae distally; bases carinate.

Pleon deeply immersed into pereon. Lateral plates well developed on all pleomeres, tuberculated on ventral surface, elongated on posterior pleomeres. Terminal, or sixth, pleomere minute. Pleopods biramous; both rami long, tapering, directed outwards, tuberculated. Endopod of pleopod I, however, much broader, triangular, directed anteromedially. Uropod uniramous, elongated and tuberculated.

**Male**—Body elongated, ovate. Cephalon completely fused with pereomere I, though lateral notches indicating juncture. First and second antennae of three and four articles, respectively.

Pereopods progressively larger posteriorly; all articles distinct. Pereopod I setose along ventral margins of propodus, carpus and merus; dactylus well developed. Pereopod VII with propodus produced ventrally; carpus setose distally.

Pleon completely fused, with no indication of pleomeres; hind margin truncated. No pleopods and uropods.

**Remarks:** The specimens of *Parapenaenella distincta* collected conform well with the description by Shiino (1949, 1958). As Shiino (1958) described, the present male specimens have unsegmented pleon and no pleopod, while male in original description has laterally five-segmented pleon with

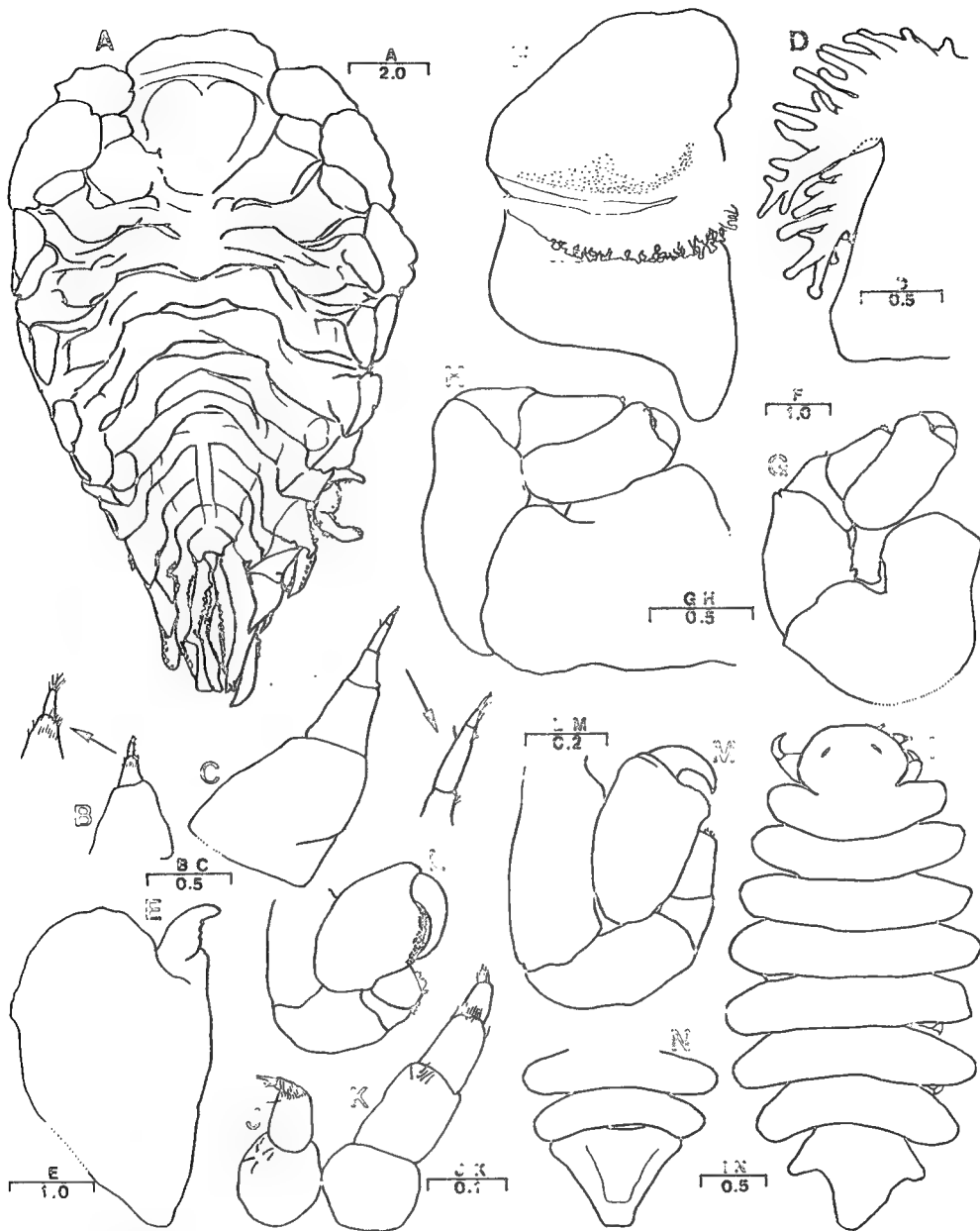


Fig. 7. *Parapenaenella distincta* Shiino. A-H. female: A, dorsal view; B, right first antenna; C, right second antenna; D, right posteroventral border of cephalon; E, right maxilliped; F, right oostegite I; G, right pereopod I; H, right pereopod VII. I-N. male: I, dorsal view; J, left first antenna; K, left second antenna; L, left pereopod I; M, left pereopod VII; N, posterior pereomeres and pleon of another female. Scale bars in mm.

uniramous pleopods.

This is the first record outside Japan.

Distribution: Korea and Japan.

## Subfamily Bopyrinae Rafinesque, 1815

Genus *Bopyroides* Stimpson, 18648. *Bopyroides hippolytes* (Krøyer, 1838) 북쪽분홍새우아감벌레 (신칭)

(Fig. 8)

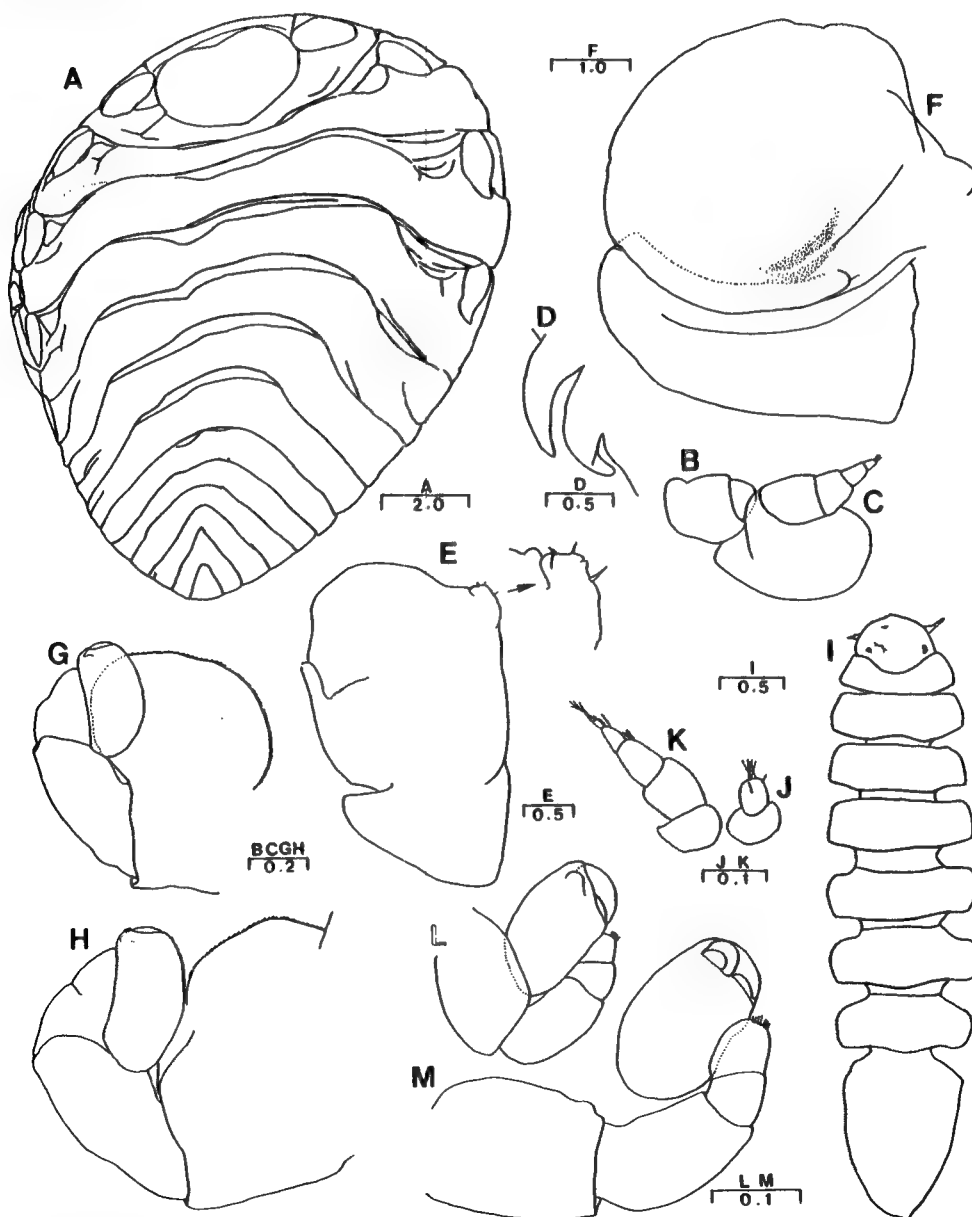
*Gyge hippolytes*: Bate and Westwood, 1868 (pp. 230-231).*Bopyroides hippolytes*: Sars, 1899 (pp. 199-200, pl. 84, fig. 2); Richardson, 1904 (pp. 64-65); 1905 (pp. 567-572,

Fig. 8. *Bopyroides hippolytes* (Krøyer). A-H. female: A, dorsal view; B, right first antenna; C, right second antenna; D, right posteroventral border of cephalon; E, right maxilliped; F, right oostegite; G, right pereopod I; H, right pereopod VII. I-M. male: I, dorsal view; J, right first antenna; K, right second antenna; L, right pereopod I; M, right pereopod VII. Scale bars in mm.

figs. 628-637); 1909 (pp. 122-123); Hansen, 1916 (pp. 203-205, pl. 15, figs. 11a-11d); Nierstrasz et Brender à Brandis, 1923 (p. 102); 1926 (pp. 32-33, figs. 100-104); Fee, 1926 (p. 29); Shiino, 1937 (pp. 293-296, fig. 1); Hatch, 1947 (p. 225, figs. 116-119); George and Strömberg, 1968 (p. 253).

**Material examined:** Infesting *Pandalus borealis* Krøyer, 1838, 1♀, Sokch'o fish market, Feb. 15, 1986, (D.H. Kwon); 5♀♀, 2♂♂, Kangnŭng fish market, Dec. 8, 1981, (I.H. Kim); 1♀, Mukho, Dec. 1, 1981, (I.H. Kim).

Infesting unknown host, 1♀, 1♂, Kangnŭng fish market, May 6, 1980, (I.H. Kim); 1♀, Kanggu, Aug. 13, 1982, (D.H. Kwon).

**Description:** **Female**—Body ovate, asymmetrical. All body segments separated.

Cephalon transversely ovate; anterior margin bilobed. Frontal lamina distinct with smooth margin. First antenna of two articles, not setose. Second antenna of five articles; basal article very large, terminal article setose distally. Posteroventral border of cephalon with two pairs of lateral falcate projections. Maxilliped with small spur, lacking palp; anteromedial flap sparsely setose.

Pereon broadest across pereomere III; all pereomeres separated and bilobed on both sides except for pereomeres VI and VII on longer side of margin. Dorsolateral bosses well developed on both sides of pereomeres I-IV. Coxal plate, though narrow, conspicuous on both sides of pereomeres I-IV. Brood pouch widely open. Oostegite I with prominent external groove, unadorned internal ridge; posterior margin rounded with angular posterolateral point. Pereopods all similar, progressively larger posteriorly; carpi and meri variably fused, ischia slender, bases very large with swollen dorsal margin.

Pleon of six pleomeres; all pleomeres distinct. First five pleomeres V-shaped in front, terminal pleomere triangular with rounded posterior margin. Five pairs of pleopods, uniramous, rudimentary. Uropod lacking.

**Male**—Cephalon transversely oval with lateral borders tapering; anterior margin semicircular, almost completely extended beyond pereon; posterior border produced posteriorly. Eyespots small. Irregular splotches of pigment scattered over dorsal surface of cephalon. First antenna of two articles with terminal article setose distally. Second antenna of six articles with distal two articles minute; distal four articles sparsely setose distally.

All pereomeres separated and discontinuous with lateral margins truncate. Pereomere V broadest. Pereopods all similar, progressively larger posteriorly; all articles distinct; dactyli long, carpi setose distally.

Pleon completely fused, with no trace of segmentation or appendages; tapering posteriorly.

**Remarks:** Though this species has been recorded from various localities of boreal waters in the North Pacific and the North Atlantic, this is the first record for Korea. Shiino (1937) compared the differences in the diagnoses given by several authors who described the present species collected from different localities and hosts. He regarded the disagreement in their diagnoses as a result due to local variation. His specimens, 12 females each carrying a male from 3 different host shrimps in the genus *Spirontocaris*, had five-segmented pleon in which terminal two pleomeres are completely fused, instead of normally occurring six-segmented one. The present specimens conform well with description given by Shiino (1937) except for having a six-segmented pleon.

The hosts of this species are hippolytid and pandalid shrimps.

**Distribution:** The North Pacific and the North Atlantic including Korea and Japan.

**9. *Pseudostegias dulcilacuum* Markham, 1980**

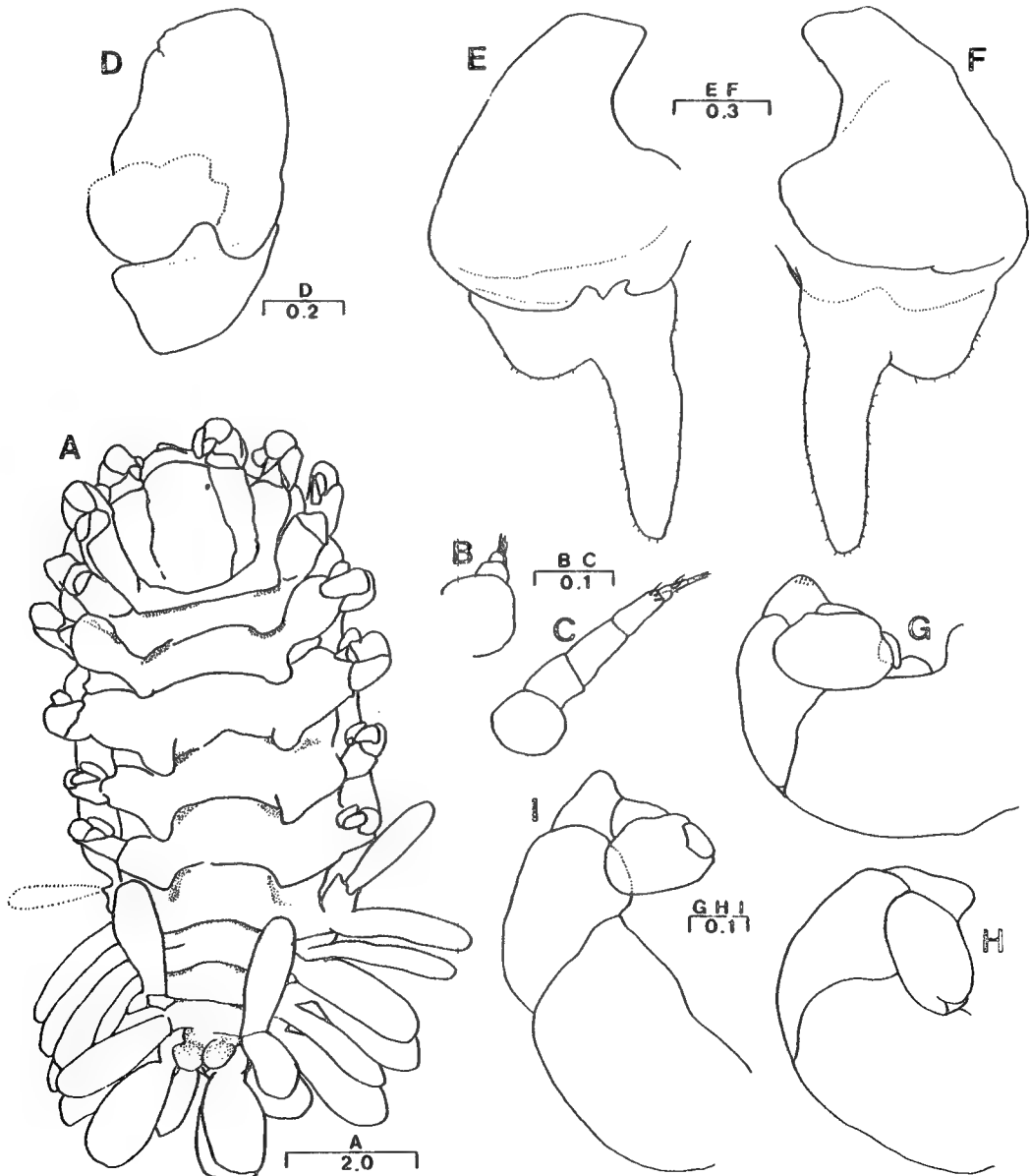
(Fig. 9)

*Pseudostegias dulcilacuum* Markham, 1980 (pp. 370-373, figs. 25-26).

**Material examined:** 1♀, Sŏnch'on, Soyado I., Aug. 6, 1982, (D.H. Kwon), infesting *Diogenes* sp.

**Description:** Female—Length 4.8 mm, width 2.2 mm across pereomere V.

Cephalon rectangular, longer than broad, deeply set into pereon but distinct from it; lateral borders subparallel; anterior margin rounded. Eyes small. First antenna of three articles, second antenna of six articles; both with terminal setae plus sparse setae on distal margins of some other articles. Maxilliped lacking palp or palpal setation.



**Fig. 9.** *Pseudostegias dulcilacuum* Markham, female: A, dorsal view; B, right first antenna; C, right second antenna; D, right maxilliped; E, right oostegite I; F, same, outer view; G, right pereopod I; H, right pereopod II; I, right pereopod III. Scale bars in mm.



Pereon subparallel-sided. Pereomere I longitudinal, bisected by cephalon, pereomeres II-IV bent anteriorly; pereomeres V-VII transverse. All but pereomere I produced into a pair of posterolateral points projecting posteriorly. Dorsolateral bosses and coxal plates lacking. Oostegites completely enclosing brood pouch. Oostegite I long and narrow; anterior region deeply concave interiorly, internal ridge bidentate; posterolateral projection slender, lanceolate, directed posteriorly.

Pleon of six pleomeres. Pleomere 1 as long as pereomere VII. Pleomeres II-VII becoming shorter and narrower posteriorly; terminal pleomere minute. First four pleomeres with lateral plates spatulate, projecting laterally or bent back anteriorly; pleomere 5 with lateral plate as dorsally placed knobs. All pleopods biramous, uropod uniramous. Lateral plates, rami of pleopods and uropods of similar shape.

**Remarks:** This species was described in Hong Kong, the type locality, based on a female and an immature female not carrying a male. The present specimen conforms well with the holotype female, but a few differences are exist between the two: the former has the body with nearly parallel sides, and anterior pleonal appendages not oval, but similar to posterior ones. Markham (1980) described that "several carpi produced into sharp angles distally," but they, in fact, are meri.

In Korea, specimen was collected from the branchial cavity of *Diogenes* sp. which is possibly the same species with the host of holotype, *Diogenes* aff. *edwardsii* (de Haan) (Markham, 1980). This is the second record of the species, extending its known range from Hong Kong to the Yellow Sea side of Korea.

**Distribution:** Korea and Hong Kong.

#### Genus *Parathelges* Bonnier, 1900

#### 10. *Parathelges enoshimensis* Shiino, 1950 참집게배불이

*Parathelges enoshimensis* Shiino, 1950 (pp. 162-164, fig. 5); Kim and Kwon, 1988 (pp. 225-227, fig. 8).

**Material examined:** Infesting *Pagurus dubius* (Ortmann, 1892), 3♀♀, 2♂♂, Sangju-ri, Namhaedo I., May 27, 1983, (D.H. Kwon).

Infesting *Pagurus geminus* McLaughlin, 1976, 33♀♀, 2 immature ♀♀, 19♂♂, Sŏngsanp'o, Cheju I., Jan. 18, 1985, (C.Y. Chang); 1♀, Mosŭlp'o, Cheju I., Aug. 23, 1982, (B.L. Choe); 1♀, 1♂, Mosŭlp'o, Cheju I., Jan. 18, 1985, (H.S. Kim); 10♀♀, 1 immature ♀, 10♂♂, Sangch'ujado I., Jul. 17, 1985, (H.S. Kim); 2♀♀, 2♂♂, Hoenggando I., Jul. 16, 1985, (H.S. Kim).

**Remark:** In Korea, this species was recently recorded from Cheju I. (Kim, and Kwon, 1988).

**Distribution:** Korea and Japan.

#### Genus *Athelges* Hesse, 1861

#### 11. *Athelges takanoshimensis* Ishii, 1914 긴발가락참집게배불이 (신칭) (Fig. 10)

*Athelges takanoshimensis* Ishii, 1914 (pp. 519-530, pl. 7); Shiino, 1934 (pp. 277-278, fig. 9); 1936b (p. 186, fig. 5); 1937 (p. 299); 1939b (p. 98); 1958 (p. 68, pl. 3, fig. 10); Markham, 1980 (pp. 373-375, fig. 27).

*Athelges takanoshimensis* Ishii var. *tenuibranchiatus* Shiino, 1936b (pp. 187-188, fig. 6).

*Athelges japonicus* Shiino, 1958 (pp. 69-71, fig. 22).

**Material examined:** Infesting *Pagurus brachiomastus* (Thallwitz, 1891), 1♀, 1♂, Kŏjin, Feb. 8, 1983, (H.S. Kim); 5♀♀, 4♂♂, Ch'ŏnbu, Ullŭngdo I., Aug. 7, 1985, (D.H. Kwon); 6♀♀, 6♂♂, Todong, Ullŭngdo I., Aug. 6, 1985, (D.H. Kwon); 1♀, 1♂, Sadong, Ullŭngdo I., Oct. 2, 1981, (H.S. Kim).

Infesting *Pagurus geminus* McLaughlin, 1976, 3♀♀, 3♂♂, Kijang, Apr. 26, 1983, (D.H. Kwon); 1♀,

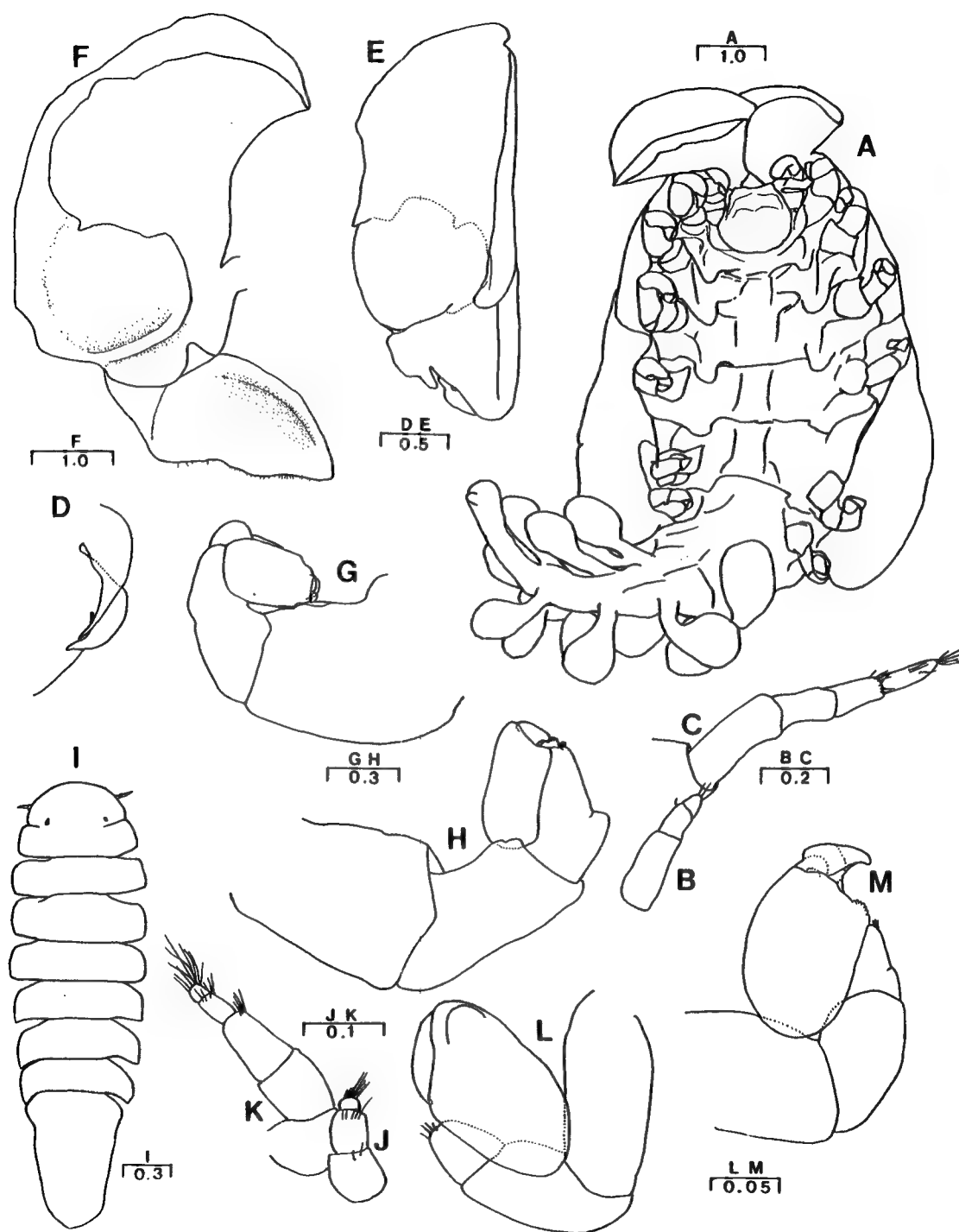


Fig. 10. *Athelges takanoshimensis* Ishii, A-H. female: A, dorsal view; B, right first antenna; C, right second antenna; D, left posteroventral border of cephalon; E, right maxilliped; F, right oostegite I, inner view; G, right pereopod I; H, right pereopod VII. I-M. male: I, dorsal view; J, right first antenna; K, right second antenna; L, right pereopod I; M, right pereopod VII. Scale bars in mm.

1♂, Hwawŏn-ri, Pogildo I., Aug. 23, 1982, (D.H. Kwon).

Infesting *Pagurus middendorfi* Brandt, 1851, 1♀, 1♂, 1 immature ♀, Hujin, Jul. 21, 1985, (D.H. Kwon).

Infesting *Pagurus dubius* (Ortmann, 1892), 33♀♀, 19♂♂, 9 immature ♀♀, Sangju-ri, Namhaedo I., May 27, 1983, (D.H. Kwon); 7♀♀, 4♂♂, 4 immature ♀♀, Sangju-ri, Namhaedo I., May 13, 1984, (D.H. Kwon); 8♀♀, 8♂♂, Pangch'ukp'o, Tolsando I., May 6, 1985, (Students of Dept. of Zoology, Seoul National Univ.); 1♀, 1 immature ♀, Imp'o, Tolsando I., May 7, 1985, (Students of Dept. of Zool., Seoul National Univ.); 2♀♀, 1♂, Nŏpto I., Wando-gun, Aug 22, 1982, (D.H. Kwon); 1♀, Pangp'o, Anmyŏndo I., May 21, 1982, (D.H. Kwon); 25♀♀, 24♂♂, Ch'ŏllip'o, Oct. 7, 1985, (H.S. Kim); 15♀♀, 15♂♂, Anhŭng, Jul. 29, 1986, (H.S. Kim).

Infesting *Pagurus pectinatus* (Stimpson, 1858), 5♀♀, 3♂♂, Mip'o, Pusan, Jan. 20, 1985, (D.H. Kwon).

**Description: Female**—Cephalon deeply sunk in pereon, but distinct from it; anterior margin slightly concave; lateral borders produced laterally; posterior margin rounded. Both antennae slender; first antenna of three articles with terminal setae; second antenna of five articles with distal two setose. Posteroventral border of cephalon with two pairs of falcate lateral projections. Maxilliped distinctly two-segmented, lacking palp or palpal setation.

All pereomeres distinct but obscure between some pereomeres medially. Each pereomere with a pair of posterolateral point variously projecting. A narrow middorsal ridge along full length. Pereomere I shortest; II and III subequal in length, longer than I; IV-VI, subequal, longest; VII shorter than VI; V broadest. Oostegites completely enclosing brood pouch. Oostegite I with anterior region strongly expanded, folded, freely projecting beyond anterior margin of cephalon, with prominent external groove; posterolateral projection tapering. Pereopods all similar in size and shape; carpi and meri variably fused or separate; meri produced ventrodistally.

Pleon cylindrical, tapering posteriorly. Five pleomeres discriminated by shallow constrictions; terminal pleomere elongated, claviform, with an anal tube at apex. Four pairs of pleopods biramous. Each pleopod consisted of two oval to oblong lobes arising from rather long, narrow, common peduncle. No uropods.

**Male**—Cephalon incompletely fused with pereon. Eyespots small. First antenna of three articles with terminal setae and sparse setae on basal two articles. Second antenna of five articles; terminal three articles bearing distal setae.

All pereomeres separate, sometimes discontinuous; pereomere IV broadest, gradually narrower in posterior pereomeres. All pereopods subequal; carpi with distal setae; carpi and meri variably fused.

Pleomeres completely fused, not indicating junctions, abruptly tapering posteriorly with rounded apex. No pleopods and uropods.

**Remarks:** Markham (1980) regarded the variety of this species, *tenuibranchiatus*, having no systematic validity. In the course of examining lots of specimens of *Athelges takanoshimensis* from various hosts, it was found that *A. takanoshimensis* and *A. japonicus* Shiino, 1958 represented merely variabilities due mainly to the differences in the shapes of gastropod shells that host hermit crabs dwell in.

*Pagurus brachiomastus* and *P. dubius* are newly recorded as hosts for this species. This is the first record of the species for Korea.

**Distribution:** Korea, Japan and Hong Kong.

Subfamily Hemiarthrinae Markham, 1972

Genus *Eophrixus* Caroli, 193012. *Eophrixus shojii* Shiino, 1941 긴발딱총새우배불이 (신칭)

(Fig. 11)

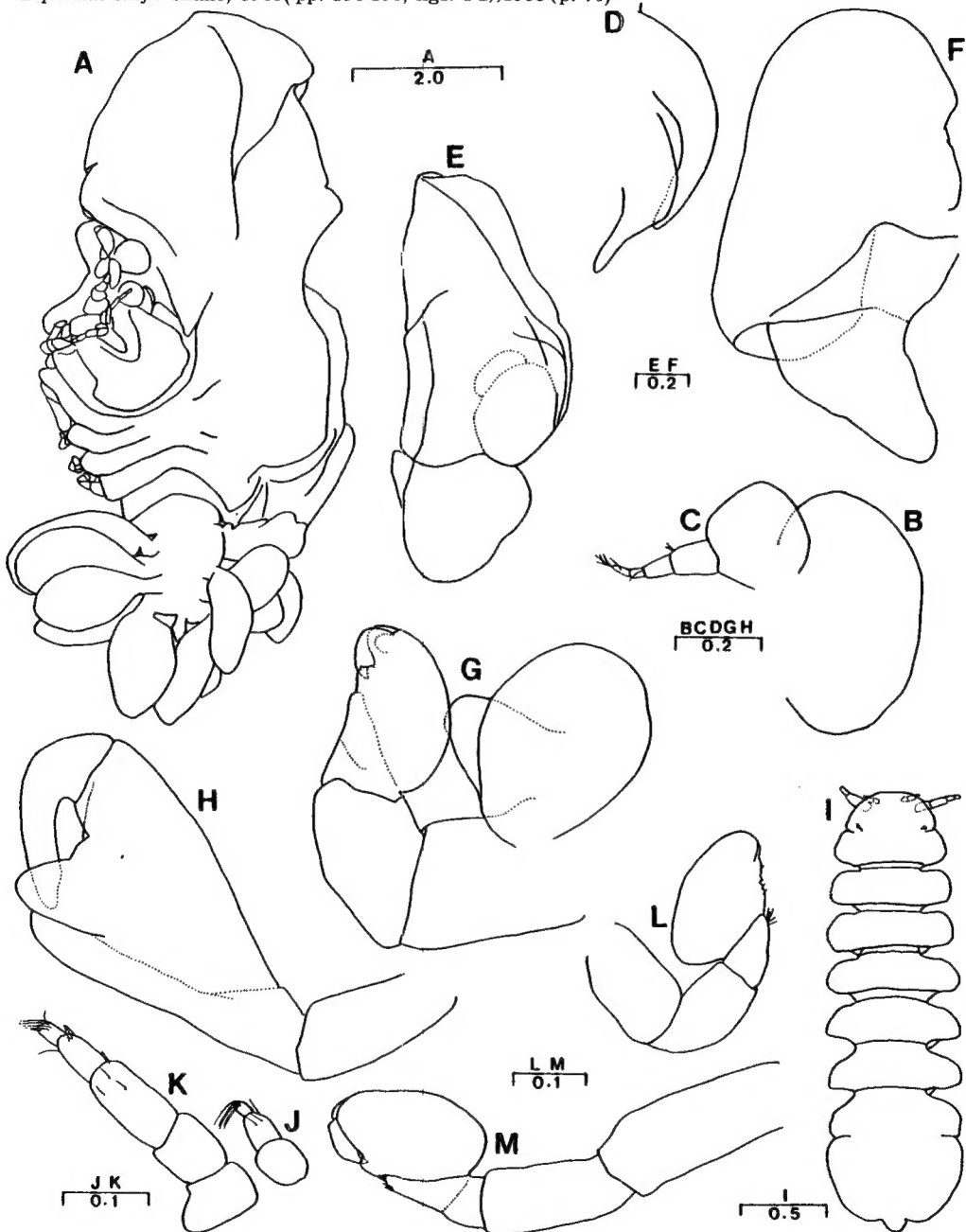
*Eophrixus shojii* Shiino, 1941 (pp. 154-156, figs. 1-2); 1958 (p. 71).

Fig. 11. *Eophrixus shojii* Shiino, A-H. female: A, dorsal view; B, left first antenna; C, left second antenna; D, left posteroventral border of cephalon; E, left maxilliped; F, left oostegite I; G, right pereopod I; H, right pereopod VII. I-M. male: I, dorsal view; J, right first antenna; K, right second antenna; L, right pereopod I; M, right pereopod VII. Scale bars in mm.

**Material examined:** 9♀♀, 3♂♂, Komso, Oct. 24, 1980, (D.H. Kwon), infesting *Alpheus japonicus* Miers, 1879.

**Description:** **Female**—Deformed, strongly asymmetrical with either side of pereon greatly swollen. No eyespots or pigments.

Cephalon deeply sunk in pereon; anterior margin bilobated. First-antenna unarticulated, lamellar. Second antenna of five articles with terminal and sparse distal setae. Maxilliped without palp. Posteroventral border of cephalon with two pairs of falcate lateral projections.

Pereomeres distinct on shorter side, obscure on longer side. Oostegite I consealed beneath others. Pereopod I with propodus, carpus and merus fused. Pereopods V-VII differently shaped from anterior pereopods. Pereopods VII with dactylus large and curved; segments fused, not distinct.

Pleon of five pleomeres, distinct only laterally; terminal pleomere very small. Lateral plates on first four pleomeres oval, lamellar, projecting freely. Four pairs of pleopods uniramous; exopods similar to lateral plates, endopods reduced to small tubercles. Uropod rudimentary.

**Male**—Cephalon incompletely fused with pereon. Eyespots small, irregularly pigmented. First antenna of three articles; second antenna of five articles.

All pereopods separate and discontiguous. Pereopods becoming longer posteriorly; carpi and meri variably fused. Pereopod I with dactylus rudimentary.

Pleon partially two-segmented, with remnants of pleomere 1 indicated by lateral notch and partial suture lines. Posterior apex provided with short anal tube.

**Remarks:** Though there are considerable variation among individuals in the shape of brood pouch, these specimens are clearly assignable to *Eophrixus shojii*. No remarkable differences are detected from Shiino (1941)'s description except for inconspicuously separated pleomeres. Markham (1980) recorded *E. shojii* from Hong Kong and discussed several differences from the type, but his specimens cannot be assignable to the species. Perhaps it would represent a new species of the genus.

This is the first record of this species for Korea.

**Distribution:** Korea and Japan.

## DISCUSSION

The present study raises the total number of species of bopyrid isopods now known from Korea from 4 to 12. But this seems no doubt represent only a portion of actual bopyrid fauna in Korea and further investigations might be needed. There are 27 decapod crustaceans known as potential hosts of bopyrids in Korea: 5 macrurans, 15 anomurans and 7 brachyurans. Of these, 13 species are now known to bear bopyrids in Korea, and 3 new hosts are found in this report such as *Argis hakodatei* (Rathbun) as a host of *Argeia pugettensis* Dana, and *Pagurus dubius* (Ortmann) and *P. brachiomastus* (Thallwitz) as hosts of *Athelges takanoshimensis* Ishii. Shiino (1972) and Markham (1980) listed 90 bopyrids found from about 80 species of hosts from Japan and 23 bopyrids from about 20 species of hosts from Hong Kong, respectively. So, probably there are really at least 30 species of bopyrids in Korea.

As may reasonably be expected in the light of oceanographic considerations, the greatest faunal affinities of bopyrids of Korea are with northern China and Japan. But the bopyrid fauna of northern China is poorly known. Eleven out of 12 species of bopyrid found in Korea have been previously recorded from Japan, while 3 species have been recorded from Hong Kong, of which 2 species have been recorded

from both Japan and Hong Kong. Of 11 species common to Korea and Japan, 3 species are widely distributed in the temperate and boreal waters in the Northern Hemisphere: two species, *Ione cornuta* Spence Bate and *Argeia pugettensis* Dana, are found along both sides of the North Pacific and another species, *Bopyroides hippolytes* (Krøyer), is found from both the North Pacific and the North Atlantic. Non-endemic bopyrids of Hong Kong, however, are largely Indo-West Pacific or pantropical in distribution (Markham, 1980).

## ABSTRACT

Bopyrid isopods collected from 35 localities in Korea were examined. Twelve species in 12 genera were identified and classified into 7 subfamilies, of which following 8 species are new to Korea: *Metabopyrus ovalis* Shiino, *Bopyrissa pyriforma* (Shiino), *Ione cornuta* Spence Bate, *Parapenaeonella distincta* Shiino, *Bopyrioides hippolytes* (Krøyer), *Pseudostegias dulcilaucum* Markham, *Athelges takanoshimensis* Ishii and *Eophrisus shojii* Shiino. *Athelges japonicus* Shiino is found out to be a junior synonym of *A. takanoshimensis* Ishii. Eight unrecorded species in Korea are described with figures. Other two species, *Apocepon pulcher* Nierstrasz et Brender à Brandis and *Argeia pugettensis* Dana, are provided with figures.

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